EPA/600/R-02/007
January 2002

Characterization of Mercury Emissions at a Chlor-Alkali Plant

VOLUME I
Report and
Appendices A-E

John S. Kinsey
U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory
Research Triangle Park, North Carolina 27711

ABSTRACT

Current estimates indicate that up to 160 short tons (146 Mg) of mercury (Hg) is consumed by the chlor-alkali industry each year. Very little quantitative information is currently available, however, on the actual Hg losses from these facilities. The Hg cell building roof vent is considered to be the most significant potential emission point in chlor-alkali plants, especially when the cells are opened for maintenance. Because of their potential importance, chlor-alkali plants have been identified as needing more accurate measurements of Hg emissions. To obtain a better understanding of the fate of Hg within their manufacturing process, the Olin Corporation voluntarily agreed to cooperate with the U.S. Environmental Protection Agency in a comprehensive study of the Hg emissions from their Augusta, GA, facility, in collaboration with other members of the Chlorine Institute representing the active chlor-alkali plants in the United States.

To investigate the Hg releases from the Olin chlor-alkali facility, the EPA's National Risk Management Research Laboratory, Air Pollution Prevention and Control Division (EPA-APPCD) in Research Triangle Park, NC, organized a special study involving multiple organizations and personnel. However, only the research conducted by EPA-APPCD involving roof vent monitoring and air flow studies conducted in the Olin cell building is discussed in this report.

The overall objective of monitoring the cell building roof vent was to determine the total elemental mercury (Hg^0) mass flux from the cell building under a range of typical wintertime meteorological conditions, including both normal operation of the cell building and routine maintenance of Hg cells and decomposers. Secondary objectives of the research were to perform an air flow mass balance for the building and to compare various Hg monitoring methods under a variety of sampling conditions. Both objectives were met during the February 2000 field sampling campaign, which showed an average Hg^0 emission rate of 0.36 g/min from the roof ventilator as determined over the 9-day monitoring period.

TABLE OF CONTENTS

Volume I

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

Volume II

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF TABLES

LIST OF ABBREVIATIONS AND SYMBOLS

APPCD	Air Pollution Prevention and Control Division
ATREEs	anemometer trees
CAPs	Chlor-alkali plants
CH_4	methane
Cl_2	chlorine gas
CO	carbon monoxide
CVAFS	cold-vapor atomic fluorescence spectrometer
DAS	data acquisition system
DMB	direct mass balance
DOAS	differential optical absorption spectrometer
DQI	data quality indicator
EPA	U.S. Environmental Protection Agency
ERG	Eastern Research Group, Inc.
FTIR	Fourier transform infrared spectrometer
H_2	hydrogen
HCl	hydrogen chloride
Hg	mercury
Hg^0	elemental mercury
LIDAR	Light Detection and Ranging
LOA	Scientific Technology Model LOA-104 optical anemometer
LRPCD	Land Remediation and Pollution Control Division
N_2O	nitrous oxide

LIST OF ABBREVIATIONS AND SYMBOLS (Continued)

NaCl	sodium chloride
NaOH	sodium hydroxide
NERL	National Exposure Research Laboratory
NIST	National Institute for Standards and Technology
NWS	National Weather Service
OECA	Office of Enforcement and Compliance Assurance
ORNL	Oak Ridge National Laboratory
OxyChem	Occidental Chemical Corporation
PI	Principal Investigator
QAPjP	Quality Assurance Project Plan
QC	quality control
SOP	Standard Operating Procedure
SF_6	sulfur hexafluoride
UM	University of Michigan
UV-DOAS	ultraviolet differential optical absorption spectrometer

UNIT CONVERSION TABLE

Multiply	By	To Obtain
atm	29.92	in. Hg
atm	760	mm Hg
ft	0.3048	m
km	0.6214	mi
L/day	0.264	gal./day
m^3/min	35.31	ft^3/min
pounds	453.6	g
short ton	0.91	metric ton
temperature (°C + 17.8)	1.8	temperature (°F)

ACKNOWLEDGMENTS

This report was prepared with the assistance of Julie Swift and Joan Bursey of Eastern Research Group, Inc., 1600 Perimeter Park Drive, Morrisville, NC 27560, under EPA Contract 68-D7-0001. Julie Swift was responsible for the tracer gas release and manual bag sampling conducted in the field as well as preparing applicable sections of the report. Joan Bursey was responsible for the QA/QC sections of the report as well as supervising its overall production. The author acknowledges the excellent contributions of both individuals.